A Merged Atmospheric Water Vapor Data Set from the A-Train'

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Current limitations in observations of atmospheric water in its gas, liquid and solid phases are central to many unresolved questions in hydrology and climate science. These shortcomings are a major reason numerical models describe the behavior of atmospheric water substance only crudely. We will create a merged satellite data set containing information about atmospheric water in its three phases - vapor, liquid and ice - and test this set in studies of the Madden-Julian oscillation. The resulting data set will be of great utility in understanding the full atmospheric component of the hydrologic cycle, and addresses the central NEWS goal of "documenting and enabling improved, observationally-based predictions of water and energy cycle consequences of Earth system variability and change." These detailed global observations will permit diagnostic analyses of atmospheric processes and provide constraints for model assessment and development. Data from several instruments flying in the A-Train satellite constellation in NASA's Earth Observing System will be combined. The first data source will be water vapor and temperature from the Atmospheric Infrared Sounder (AIRS) on Aqua. The AIRS observations will be merged in the upper troposphere with water vapor and temperature from the EOS Microwave Limb Sound (EOS-MLS), providing water vapor and temperature information from the surface into the upper stratosphere. Cloud liquid water information will be obtained from the Advanced Microwave Sounding Radiometer for EOS (AMSR-E) on Aqua. Ice water information will come from EOS-MLS, AMSR-E and the Advanced Microwave Sounder (AMSU) on Aqua, all of which have experimental ice retrieval algorithms. Additional cloud ice information will come from AMSU-B on the NOAA-16 satellite also in the A-Train. We will constrain the upper altitude of the cloud ice and liquid water using cloud top heights from AIRS and the Moderate Resolution Infrared Sounder (MODIS) on Aqua. We will also exploit cloud height and water content information from CloudSat when it is launched in 2005. All observations will be reported on a regular, nested grid along the A-Train orbit track to simplify their use by modelers and data analysts. The proposal team has expertise in retrieval techniques of physical parameters of the atmosphere, atmospheric hydrological processes and the application of satellite data to model diagnosis and development.